

Attachment 7
Economic Analysis-Flood Damage Reduction Costs and Benefits

The Project proposes to construct a 1740 acre-foot flood control and aquifer recharge basin in the City of Fontana, north of Interstate 10 Freeway between Citrus and Beech Avenues. The system captures a watershed area of 2,580 acres and is capable of delivering approximately 1750 acre feet of storm water during an average rainfall year. The Project also intends to improve approximately 5,200 linear feet of the West Fontana Channel between Juniper Avenue and Lime Avenue. The Project will eliminate 1,150 acres of FEMA identified flood hazard areas of mixed residential, commercial, and industrial properties, as shown on Attachment 7.1.

The Project's economic costs related to flood control include purchase of available land, construction of 1740 acre-foot flood control and aquifer recharge basin, and improvements to the West Fontana Channel. As shown on Attachment 4.1, the land acquisition costs are estimated at \$4.5 million and the flood control construction costs are estimated at \$9.9 million. The Project's total costs are shown on Table 6 in Attachment 4.

Historically, the City has had flooding along the Metrolink corridor and areas south of the corridor during moderate storm events. The existing West Fontana Channel is an earthen channel located north of the Metrolink rail line and conveys approximately 1,000 cubic feet per second (cfs) in existing condition. Based on the City's storm drain master plan, the West Fontana Channel will be required to convey 3,045 cfs of storm water runoff adjacent to the proposed basin site. As demonstrated on the FEMA Flood Insurance Rate Maps, shown in Attachment 3.1, the areas immediately downstream of the Project experience flood inundation up to 3 feet.

The Project will construct the necessary improvements to ensure 100 year flood protection. The existing Vulcan Pit will be excavated and graded to provide adequate flood volume storage and reduce the peak flow to mitigate downstream flooding. The proposed basin is estimated to hold 1740 acre-feet based on preliminary calculations; however, further analysis will be required. The size of the West Fontana Channel will be increased to convey the 100 year stormwater runoff as indicated provided in the City's master plan of drainage.

The City's goals and objectives of the Project are to improve flood protection, enhance aquifer recharge, reduce dependence on imported water supplies and to enhance water quality in the Chino Basin. In addition to flood protection of the Metrolink rail line, numerous residential, commercial, and industrial properties will secure water supplies, reduce replenishment assessments, and stabilize water rates.

At the completion of construction, Project benefits will immediately be received. The improved West Fontana Channel and Vulcan Basin will provide immediate flood protection to the existing flood hazard area and along the Metrolink corridor. All values for included tables have been described, qualified, and/or supported in the comment section of each table.

Table 10 - Annual Cost of Flood Damage Reduction Project
 (All Costs should be in 2009 Dollars)

Proposal: Vulcan Pit Flood Control and Aquifer Recharge

Year	Initial Cost		Operations and Maintenance Costs ^{1.)}						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	
	Grand Total Costs	Administration	Operations	Maintenance	Replacement	Other	Total Costs (a) + ... + (f)	Discount Factor	Discounted Costs (g)* (h)	
2009	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	1.000	\$ -	
2010	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0.943	\$ -	
2011	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0.890	\$ -	
2012	\$ 19,500,000	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 19,508,000	0.840	\$ 16,386,720	
2013	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.792	\$ 6,336	
2014	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.747	\$ 5,976	
2015	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.705	\$ 5,640	
2016	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.665	\$ 5,320	
2017	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.627	\$ 36,377	
2018	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.592	\$ 4,736	
2019	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.558	\$ 4,464	
2020	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.527	\$ 4,216	
2021	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.497	\$ 3,976	
2022	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.469	\$ 27,210	
2023	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.442	\$ 3,536	
2024	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.417	\$ 3,336	
2025	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.394	\$ 3,152	
2026	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.371	\$ 2,968	
2027	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.350	\$ 20,306	
2028	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.330	\$ 2,640	
2029	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.312	\$ 2,496	
2030	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.294	\$ 2,352	
2031	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.278	\$ 2,224	
2032	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.262	\$ 15,201	
2033	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.247	\$ 1,976	
2034	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.233	\$ 1,864	
2035	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.220	\$ 1,760	
2036	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.207	\$ 1,656	
2037	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.196	\$ 11,371	

Year	Initial Cost	Operations and Maintenance Costs ^{1.)}						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Grand Total Costs	Administration	Operations	Maintenance	Replacement	Other	Total Costs (a) + ... + (f)	Discount Factor	Discounted Costs (g) * (h)
2038	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.185	\$ 1,480
2039	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.174	\$ 1,392
2040	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.164	\$ 1,312
2041	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.155	\$ 1,240
2042	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.146	\$ 8,471
2043	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.138	\$ 1,104
2044	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.130	\$ 1,040
2045	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.123	\$ 984
2046	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.116	\$ 928
2047	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.109	\$ 6,324
2048	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.103	\$ 824
2049	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.097	\$ 776
2050	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.092	\$ 736
2051	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.087	\$ 696
2052	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.082	\$ 4,757
2053	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.077	\$ 616
2054	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.073	\$ 584
2055	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.069	\$ 552
2056	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.065	\$ 520
2057	\$ -	\$ 2,000	\$ 9,000	\$ 9,000	\$ 38,018	\$ -	\$ 58,018	0.060	\$ 3,481
2058	\$ -	\$ 2,000	\$ 3,000	\$ 3,000	\$ -	\$ -	\$ 8,000	0.058	\$ 464

Total Present Value of Discounted Costs: \$ 16,606,090

Notes:

1.) The incremental change in O&M costs attributable to the project.

Comments:

- (a) Grand Total Costs are take from and further described in Table 6.
- (b) Administrative costs are estimated to include two weeks of work per year at a rate of \$25 per hour.
- (c) Operation costs are estimated to include one week of work per year at a rate of \$75 per hour. Additionally, pipe repair, sediment build-up removal, and scouring of the basin floor, will require extra costs every five years estimated at three weeks of work at a rate of \$75 per hour.
- (d) Maintenance costs are estimated to include one week of work per year at a rate of \$75 per hour. Additionally, pipe repair, sediment build-up removal, and scouring of the basin floor, will require extra costs every five years estimated at three weeks of work at a rate of \$75 per hour.
- (e) Replacement costs include sediment build-up removal (12,600 cubic-yards) and scouring of the basin floor at a rate of \$3 per cubic-yard, to be done every 5 years.
- (f) Other costs were not applicable.
- (g) Total Costs are the summation of columns (a) through (f).
- (h) Discount Factors are based on a 6% discount rate and a 50 year analysis period, as provided in the application.
- (i) Discounted Costs are Total Costs multiplied by the Discount Factor.

Table 11 - Event Damage

Hydrologic Event	Event Probability	Damage if Flood Structures Fail	Probability Structural		Event Damage		Event Benefit (Million \$)
			Without Project	With Project	Without Project	With Project	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
25-Year	0.040	\$ 11,000,000	1.00	0.00	\$ 11,000,000	0.00	\$ 11,250,000
50-Year	0.020	\$ 47,000,000	1.00	0.00	\$ 47,000,000	0.00	\$ 47,000,000
100-Year	0.010	\$ 74,000,000	1.00	0.00	\$ 74,000,000	0.00	\$ 74,700,000

Comments:

- (a) Three hydrologic events were selected based on available drainage master plan data.
- (b) Probability is determined by the occurrence of the hydrologic flood event.
- (c) Based on Flood Rapid Assessment Model (FRAM), included as Attachment 7.2.
- (d) Without the project, flooding will occur at each of the specified hydrologic event, based on capacity of existing system and as indicated on FEMA Flood Hazard Maps included as Attachment 3.1.
- (e) The project is designed to mitigate a 100 year hydrologic event.
- (f) - (g) Event Damage is based on the cost of structural failure times the probability of occurrence.
- (h) Event Benefit is the money that is expected to be saved based on applied Project and probability.

Table 12 - Present Value of Expected Annual Damage Benefits**Proposal: Vulcan Pit Flood Control and Aquifer Recharge**

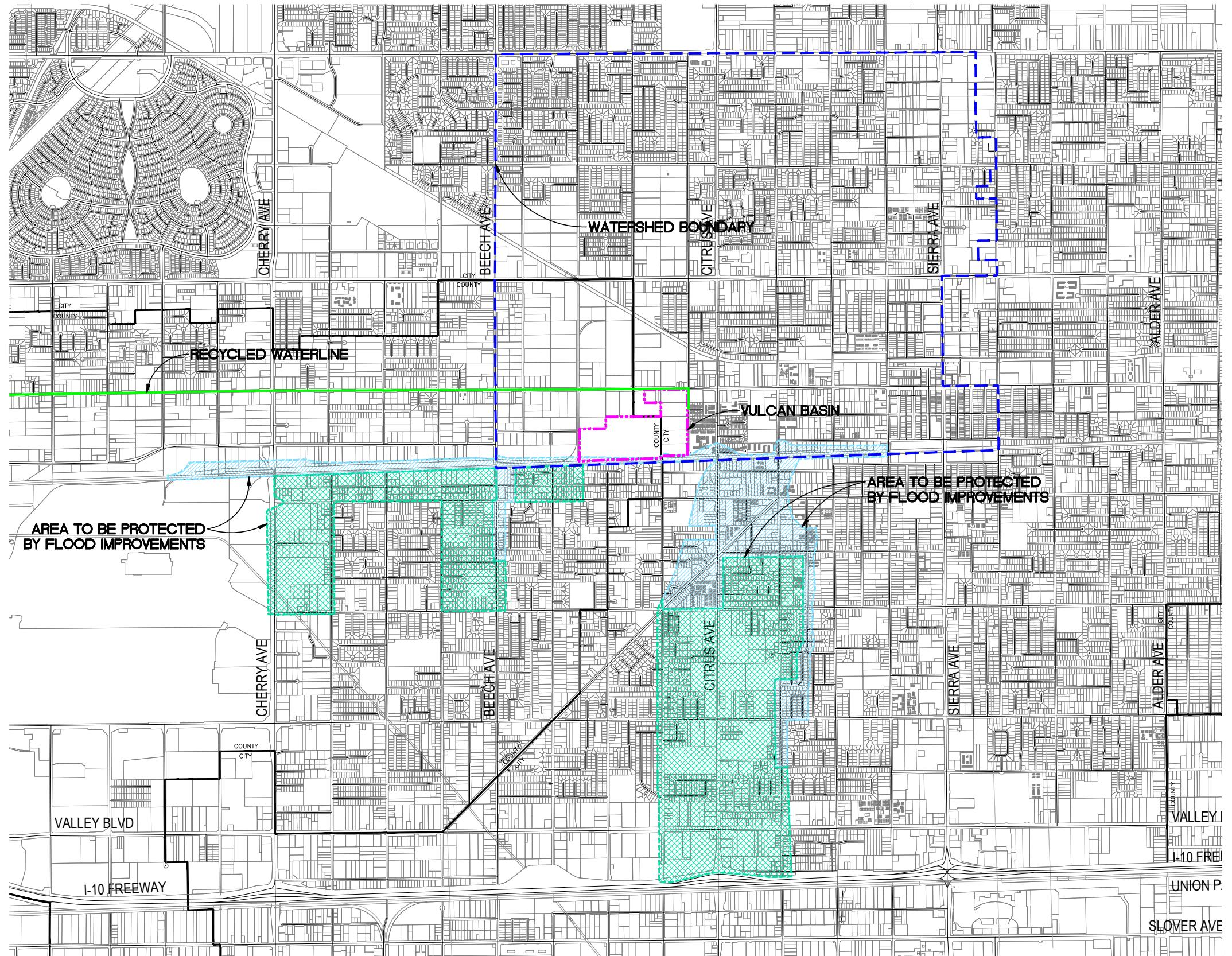
(a)	Expected Annual Damage Without Project ^{1.)}		\$ 1,180,000
(b)	Expected Annual Damage With Project ^{1.)}		\$ -
(c)	Expected Annual Damage Benefit	(a)-(b)	\$ 1,180,000
(d)	Present Value Coefficient ^{2.)}		15.76
(e)	Present Value of Future Benefits	(c) * (d)	\$ 18,596,800

Notes:

- 1.) This Project assumes no population growth thus EAD will be constant over analysis period
- 2.) 6% discount rate; 50-year analysis period

Comments:

- (a) - (b) Based on Actual Loss Probability Curves determined in FRAM analysis, see Attachment 7.2.



SCALE: 1" = 1,200'



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CITY OF FONTANA	ATTACHMENT 7.1
	FLOOD HAZARD AREA

Attachment 7.2

FRAM Analysis

DWR Levee Mitigation Prioritization Tool

To Read Instructions:

[Read Instructions](#)

To Enter Project Information:

[Enter Project Information](#)

To Enter Special Cases:

[Enter Special Cases](#)

View Cost-Benefit Analysis:

[Cost-Benefit Analysis](#)

View Stage Damage Graph:

[Stage v Damage Curve](#)

View AAD Graph (Actual):

[Loss Probability Curve](#)

Instructions

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Project information should be entered in the 'Inputs' tab only. Information is required in all cells highlighted green. Example: 

Output information is provided in the 'BCA Summary' tab. Project calculations are performed in the sheets described in the Model Map.

Model Map

<u>Sheet Name</u>	<u>Description</u>
Menu:	Front page of model, with links to key sheets
Instructions:	Description of how this model should be used
Inputs:	Project information to be entered by user
BCA Summary:	Summary data resulting from Cost-Benefit Analysis
Assumptions:	Master page containing unit damage assumptions
Depth Damage Curves	Data describing stage damage relationships
Residential:	Direct residential building and contents costs
Commercial & Industrial:	Direct commercial and industrial building and contents costs
Agricultural:	Direct losses to agricultural production
Roads	Direct Losses to roads and infrastructure
Special Cases:	Table for entering information about special case buildings
Without Project EAD	Calculation of Estimated Annual Damages (EAD) without-project
Graph Data	Data used to develop graphical outputs
With Project EAD	Calculation of Estimated Annual Damages (EAD) with-project
Stage v Damage Curve	Graph of flood stage v flood damages
Loss Probability Curve	Graph of flood exceedance probability v flood damages

Inputs[Return to Menu](#)

Project Name:	Vulcan Pit Flood Control and Aquifer Recharge
Cost of Project:	\$ 20,006,944
Description:	

Number of Events Modeled	Without Project						With Project					
	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
3	25	50	100				25	50	100			
Average Return Interval (ARI)												
Annual Probability of Exceedance	0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!	0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!
Probability of Levee Failure	1.00	1.00	1.00				0.00	0.00	0.00			
Water Surface Elevation - channel (f)	1249.40	1249.70	1250.00									
Flood Warning Time (hours)	0.5	0.5	0.5									
Flood Experience	Y	Y	Y				N	N	N			
Period of Inundation (days)	1	1	1									
HEC-FIA DATA INPUTS	N											
Residential Structural Damages (\$)												
Residential Contents Damages (\$)												
Residential Debris & Cleanup (\$)												
Commercial Structural Damages (\$)												
Commercial Contents Damages (\$)												
Commercial Debris & Cleanup (\$)												
Industrial Structural Damages (\$)												
Industrial Contents Damages (\$)												
Industrial Debris & Cleanup (\$)												
Agricultural Structural Damages (\$)												
Agricultural Contents Damages (\$)												
Agricultural Debris & Cleanup (\$)												
Residential Properties												
Ratio Depreciated Value to Replacement Value	100%	100%	100%									
Average Flood depth above ground level (f)	0.40	0.70	1.00									
Rural - Res: Homesteads												
Rural - Other: Barns, sheds												
Urban Res: Single story (no base)												
Urban Res: Single story (basement)												
Urban Res: Two plus story (no base)												
Urban Res: Two plus story (basement)												
Mobile home												
Commercial Properties												
Ratio Depreciated Value to Replacement Value	100%	100%	100%									
Average Flood depth above ground level (f)	0.40	0.70	1.00									
low value	building area inundated (sq.f.)											
medium value	building area inundated (sq.f.)											
high value	building area inundated (sq.f.)											
Industrial Properties												
Ratio Depreciated Value to Replacement Value	100%	100%	100%									
Average Flood depth above ground level (f)	0.40	0.70	1.00									
low value	building area inundated (sq.f.)											
medium value	building area inundated (sq.f.)											
high value	building area inundated (sq.f.)											
Agricultural Production												
Corn	ac.											
Rice	ac.											
Walnuts	ac.											
Almonds	ac.											
Cotton	ac.											
Tomatoes	ac.											
Wine Grapes	ac.											
Alfalfa	ac.											
Pasture	ac.											
Safflower	ac.											
Sugar Beets	ac.											
Beans	ac.											
Other	ac.											
Roads												
length of arterial roads inundated (miles)												
length of major roads inundated (miles)	1.78	3.12	4.5									
length of minor roads inundated (miles)	0.91	1.60	2.3									
length of unsealed roads inundated (miles)	1.28	2.24	3.2									

Extrapolate Y-intercept N

Summary of Cost-Benefit Analysis

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Project Name:

Vulcan Pit Flood Control and Aquifer Recharge

Description

	0
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Proposed project capital cost:

\$ 20,006,944

[Note: construction costs which are assumed to occur in one year.]

Change in annual O&M costs:

\$ -

[Note: the change in annual O&M costs compared to without project conditions.]

PV of future O&M costs:

\$ -(at **6%** discount rate over **50** years)

PV of future costs

\$ 20,006,944

[Note: the sum of capital costs plus the PV of O&M costs.]

Benefits

	Actual	Potential	
EAD without project	\$ 1,937,538	\$ 1,974,976	[Note: for stormwater projects use "Potential" damage which ignores storm warning effects.]
EAD with project	\$ -	\$ -	
Annual Benefit:	\$ 1,937,538	\$ 1,974,976	
PV of Future Benefits:	\$ 30,539,207	\$ 31,129,300	(at 6% discount rate over 50 years)

Cost-Benefit Analysis

	Actual	Potential	
Net Present Value (NPV)	\$ 10,532,263	\$ 11,122,356	(at 6% discount rate over 50 years)
Benefit:Cost Ratio	1.526	1.556	

NPV Sensitivity to Discount Rate:

	Actual	Potential
4%	\$ 21,615,610	\$ 22,419,859
5%	\$ 15,364,609	\$ 16,048,074
6%	\$ 10,532,263	\$ 11,122,356
7%	\$ 6,732,529	\$ 7,249,201
8%	\$ 3,695,900	\$ 4,153,897

Model Assumptions

Residential

Foundation heights

Structure Category	Foundation Height (ft)
Rural - Res: Homesteads	1.5
Rural - Other: Barns, sheds	0
Urban Res: Single story (no base)	1.1
Urban Res: Two plus story (no base)	1.1
Mobile home	2.0
Commercial: Low	1
Commercial: Medium	1
Commercial: High	1
Industrial: Low	0.5
Industrial: Medium	0.5
Industrial: High	0.5

Estimate Replacement Value (assumed proxy for depreciated value)

Structure Category	Unit Cost \$/ft ² (2)	Average Size ft ² (1)	Constructio n Cost
Rural - Res: Homesteads	159	1900	302100
Rural - Other: Barns, sheds	98	4000	392000
Urban Res: Single story (no base)	159	1900	302100
Urban Res: Two plus story (no base)	155	2200	341000
Mobile home (3)	98	1180	115640
Commercial: Low	120	0	0
Commercial: Medium	142	0	0
Commercial: High	207	0	0
Industrial: Low	120	0	0
Industrial: Medium	142	0	0
Industrial: High	207	0	0

1. Residential Square Footage Source: Sacramento County Tax Assessor Unit Cost and Commercial/Industrial/Public Square Footage Assumptions Source: Saylor Publications, Inc, 2007 Current Construction Costs

2. Replacement unit cost per square foot reflects average costs in the San Franc

3. According to FEMA guidance, replacement costs per square foot for mobile homes and barns and outbuildings are similar.

Other

External damages garden/outdoor areas \$/building	\$ 5,000
Cleanup \$/building	\$ 4,000
Number of residents per residential property	2.6

Commercial / Industrial Buildings

Clean-up costs as a percentage of direct structural damages	30%
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Calculation of Other Direct Damages

Percentage of residential direct damages applied as indirect:	25%
Percentage of comm/ind. direct damages applied as indirect:	25%
HEC-FIA only: Percentage all building direct damages applied as indirect	25%
Percentage of roads direct damages applied as indirect:	25%

NPV Calculation

Discount Rate	6%
Time Horizon	50 years

Roads

Cost per mile of highway road inundated	\$ 250,000
Cost per mile of major road inundated	\$ 100,000
Cost per mile of minor road inundated	\$ 30,000
Cost per mile of unsealed road inundated	\$ 10,000

Agricultural Damages

	Weighted, Average Annual Damages (\$/acre)	Establishment Costs (\$/acre)	Land Cleanup & rehabilitation (\$/acre)	Total <5 d) (\$/acre)	Total (>=5 d) (\$/acre)	
Corn	\$48	\$0	\$246	\$293	\$293	
Rice	\$227	\$0	\$243	\$471	\$471	
Walnuts	\$585	\$5,284	\$243	\$828	\$6,112	
Almonds	\$1,618	\$3,514	\$243	\$1,862	\$5,376	
Cotton	\$301	\$0	\$246	\$547	\$547	
Tomatoes	\$1,015	\$0	\$235	\$1,250	\$1,250	
Wine Grapes	\$3,241	\$3,240	\$235	\$3,476	\$6,716	
Alfalfa	\$250	\$246	\$243	\$493	\$739	
Pasture	(\$15)	\$82	\$272	\$257	\$339	
Safflower	\$164	\$0	\$241	\$405	\$405	
Sugar Beets	\$313	\$0	\$262	\$575	\$575	
Beans	\$111	\$0	\$246	\$356	\$356	
Other	\$0	0	\$246	\$246	\$246	

Source: Comp Study

Establishment Costs are 50% costs of total establishment costs

Calculation of Actual to Potential Damages Ratio

Without Project						With Project					
Event 1	Event 2	Event 3	Event 4	Event	Event 6	Event	Event 2	Event 3	Event 4	Event 5	Event 6
Warning Time: hours	0.5	0.5	0.5	0	0	0	0	0	0	0	0
Recent Flood Expe Y / N	Y	Y	Y	0	0	0	N	N	N	0	0
Actual : Potential Ratio	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Warning Time	Experienced Community	Inexperienced Community
< 2 hours	0.8	0.9
	Linear reduction from 0.8 at 2 hours to 0.4 at 12 hours	
2-12 hours	0.4	0.7

Occ_Name	Cat_Name	Occ_Description	Parameter	Depth (ft) above First Finished Floor (FFE)																		
				-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1ST-NB	RES	one story, no basement	Stage	0	2.5	13.4	23.3	32.1	40.1	47.1	53.2	58.6	63.2	67.2	70.5	73.2	75.4	77.2	78.5	79.5	80.2	80.7
1ST-NB	RES		S	0	2.4	8.1	13.3	17.9	22	25.7	28.8	31.5	33.8	35.7	37.2	38.4	39.2	39.7	40	40	40	40
1ST-NB	RES		C	0	2.4	8.1	13.3	17.9	22	25.7	28.8	31.5	33.8	35.7	37.2	38.4	39.2	39.7	40	40	40	40
2ST-NB	RES	two or more stories, no basement	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2ST-NB	RES		S	0	3	9.3	15.2	20.9	26.3	31.4	36.2	40.7	44.9	48.8	52.4	55.7	58.7	61.4	63.8	65.9	67.7	69.2
2ST-NB	RES		C	0	1	5	8.7	12.2	15.5	18.5	21.3	23.9	26.3	28.4	30.3	32	33.4	34.7	35.6	36.4	36.9	37.2
FARM	FAR	Farm Homesteads	Stage	-10	-3	-2	-1	0	1	2	3	4	5	6	7	8	10	13	15	19	21	25
FARM	FAR		S	0	0	0	0	0	4	9	13	18	22	27	31	35	38	49	49	49	49	49
FARM	FAR		C	0	0	0	0	0	0	6	30	54	69	75	78	80	80	80	100	100	100	100
MOBILE	MOB	Mobile homes	Stage	-10	-3	-2	-1	0	1	2	3	4	5	6	7	8	10	13	15	19	21	25
MOBILE	MOB		S	0	0	0	0	0	8	44	63	73	78	80	81	82	82	82	82	82	82	82
MOBILE	MOB		C	0	0	0	0	0	0	27	49	64	70	76	78	79	81	83	83	83	83	83
PUBLIC	PUB	Public buildings	Stage	-10	-3	-2	-1	0	1	2	3	4	5	6	7	8	10	13	15	19	21	25
PUBLIC	PUB		S	0	0	0	0	0	8	22	30	35	39	41	44	46	48	49	49	49	49	49
PUBLIC	PUB		C	0	0	0	0	0	0	17.5	25	30	34	37	39	40.5	41.5	42	42	42	42	42
INDUSTRY	IND	Industrial Buildings	Stage	-10	-3	-2	-1	0	1	2	3	4	5	6	7	8	10	13	15	19	21	25
INDUSTRY	IND		S	0	0	0	0	0	4	9	13	18	22	27	31	35	38	49	49	49	49	49
INDUSTRY	IND		C	0	0	0	0	0	0	72	75	76.5	78	81	84	87	90	96	102	108	114	120
COMMERCIAL	COM	Commercial Buildings	Stage	-10	-3	-2	-1	0	1	2	3	4	5	6	7	8	10	13	15	19	21	25
COMMERCIAL	COM		S	0	0	0	0	0	4	9	13	18	22	27	31	35	38	49	49	49	49	49
COMMERCIAL	COM		C	0	0	0	0	0	0	11	30	54	69	75	78	80	80	100	100	100	100	100

NOT USED

Residential Buildings

Commercial & Industrial Buildings

		Without Project						With Project					
		Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
ARI:		25	50	100	0	0	0	25	50	100	0	0	0
Probability of Levee Failure		1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial													
'Flood depth above ground level (ft)		0.40	0.70	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
low building size		179382	313919	448456	0	0	0	0	0	0	0	0	0
medium building size		179382	313919	448456	0	0	0	0	0	0	0	0	0
high building size		0	0	0	0	0	0	0	0	0	0	0	0
Industrial													
'Flood depth above ground level (ft)		0.40	0.70	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
low building size		914830	1600953	2287075	0	0	0	0	0	0	0	0	0
medium building size		914830	1600953	2287075	0	0	0	0	0	0	0	0	0
high building size		0	0	0	0	0	0	0	0	0	0	0	0
Structural Damages													
<i>Commercial</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
low		\$	-	\$	-	\$	2,152,586	\$	-	\$	-	\$	-
medium		\$	-	\$	-	\$	2,547,227	\$	-	\$	-	\$	-
high		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<i>Commercial HEC-FIA</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<i>Industrial</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
low		\$	-	\$	7,684,572	\$	10,977,960	\$	-	\$	-	\$	-
medium		\$	-	\$	9,093,410	\$	12,990,586	\$	-	\$	-	\$	-
high		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<i>Industrial HEC-FIA</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Total Structural Damages		\$	-	\$	16,777,982	\$	28,668,360	\$	-	\$	-	\$	-
Contents Damages													
<i>Commercial</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
low		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
medium		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
high		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<i>Commercial HEC-FIA</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<i>Industrial</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
low		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
medium		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
high		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<i>Industrial HEC-FIA</i>		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Actual:Potential Ratio		0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total Contents Damages: Actual		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Total Contents Damages: Potential		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Clean-up/ Other Costs		\$	-	\$	5,033,395	\$	8,600,508	\$	-	\$	-	\$	-
Clean-Up/ Other Costs: HEC-FIA		\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Sum Actual Damages		\$	-	\$	21,811,377	\$	37,268,868	\$	-	\$	-	\$	-
Sum Potential Damages		\$	-	\$	21,811,377	\$	37,268,868	\$	-	\$	-	\$	-
Total Damage with levee failure (\$):		\$	-	\$	21,811,377	\$	37,268,868	\$	-	\$	-	\$	-
Total Damage with levee failure (\$):		\$	-	\$	21,811,377	\$	37,268,868	\$	-	\$	-	\$	-
Indirect Actual Damages		\$	-	\$	5,452,844	\$	9,317,217	\$	-	\$	-	\$	-
Indirect Potential Damages		\$	-	\$	5,452,844	\$	9,317,217	\$	-	\$	-	\$	-

Agricultural Damages

Roads

Special Cases - Dollar Damages Incurred

[Return to Menu](#)

Calculation of Without Project EAD

	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Y Intercept
Average Recurrence Interval (ARI)	25	50	100	0	0	0	0
AEP	0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!	0
Actual Damage to Residential Buildings (\$)	\$ 8,782,581	\$ 15,369,516	\$ 21,956,452	\$ -	\$ -	\$ -	\$ -
Potential Damage to Residential Buildings (\$)	\$ 9,188,688	\$ 16,080,203	\$ 22,971,719	\$ -	\$ -	\$ -	\$ -
Actual Damage to Commercial/Industrial Buildings (\$)	\$ -	\$ 21,811,377	\$ 37,268,868	\$ -	\$ -	\$ -	\$ -
Potential Damage to Commercial/Industrial Buildings (\$)	\$ -	\$ 21,811,377	\$ 37,268,868	\$ -	\$ -	\$ -	\$ -
Damage to Agriculture (\$)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Damage to Roads (\$)	\$ 218,462	\$ 382,309	\$ 546,155	\$ -	\$ -	\$ -	\$ -
Actual Indirect Costs	\$ 2,250,261	\$ 9,390,800	\$ 14,942,869	\$ -	\$ -	\$ -	\$ -
Potential Indirect Costs	\$ 2,351,787	\$ 9,568,472	\$ 15,196,685	\$ -	\$ -	\$ -	\$ -
Special Cases	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Actual Damages	\$ 11,251,303	\$ 46,954,002	\$ 74,714,343	\$ -	\$ -	\$ -	\$ 74,714,343
Total Potential Damages	\$ 11,758,937	\$ 47,842,361	\$ 75,983,427	\$ -	\$ -	\$ -	\$ 75,983,427
EAD (Actual)	\$ 1,937,538						
EAD (Potential)	\$ 1,974,976						

Potential Damages

Without Project

Water Surface Elevation - channel (f)	1249.4	1249.7	1250	1250	1250	1250
ARI	25	50	100	0	0	0
Probability of Exceedence (AEP)	0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!
Damages incurred	\$ 11,758,937	\$ 47,842,361	\$ 75,983,427	\$ -	\$ -	\$ 75,983,427

With Project

0	0	0	0	0	0	0
25	50	100	0	0	0	0
0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

Actual Damages

Without Project

Water Surface Elevation - channel (f)	1249.4	1249.7	1250	0	0	0
ARI	25	50	100	0	0	0
Probability of Exceedence (AEP)	0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!
Damages incurred	\$ 11,251,303	\$ 46,954,002	\$ 74,714,343	\$ -	\$ -	\$ 74,714,343

With Project

0	0	0	0	0	0	0
25	50	100	0	0	0	0
0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

Without Project

Water Surface Elevation - channel (f)	25	50	100	0	0	0
Probability of Exceedence (AEP)	0.040	0.020	0.010	0.010	0.010	0.010
Potential	\$ 11,758,937	\$ 47,842,361	\$ 75,983,427	\$ 75,983,427	\$ 75,983,427	\$ 75,983,427
Actual	\$ 11,251,303	\$ 46,954,002	\$ 74,714,343	\$ 74,714,343	\$ 74,714,343	\$ 74,714,343

With Project

Water Surface Elevation - channel (f)	25	50	100	0	0	0
Probability of Exceedence (AEP)	0.040	0.020	0.010	0.010	0.010	0.010
Potential	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Actual	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

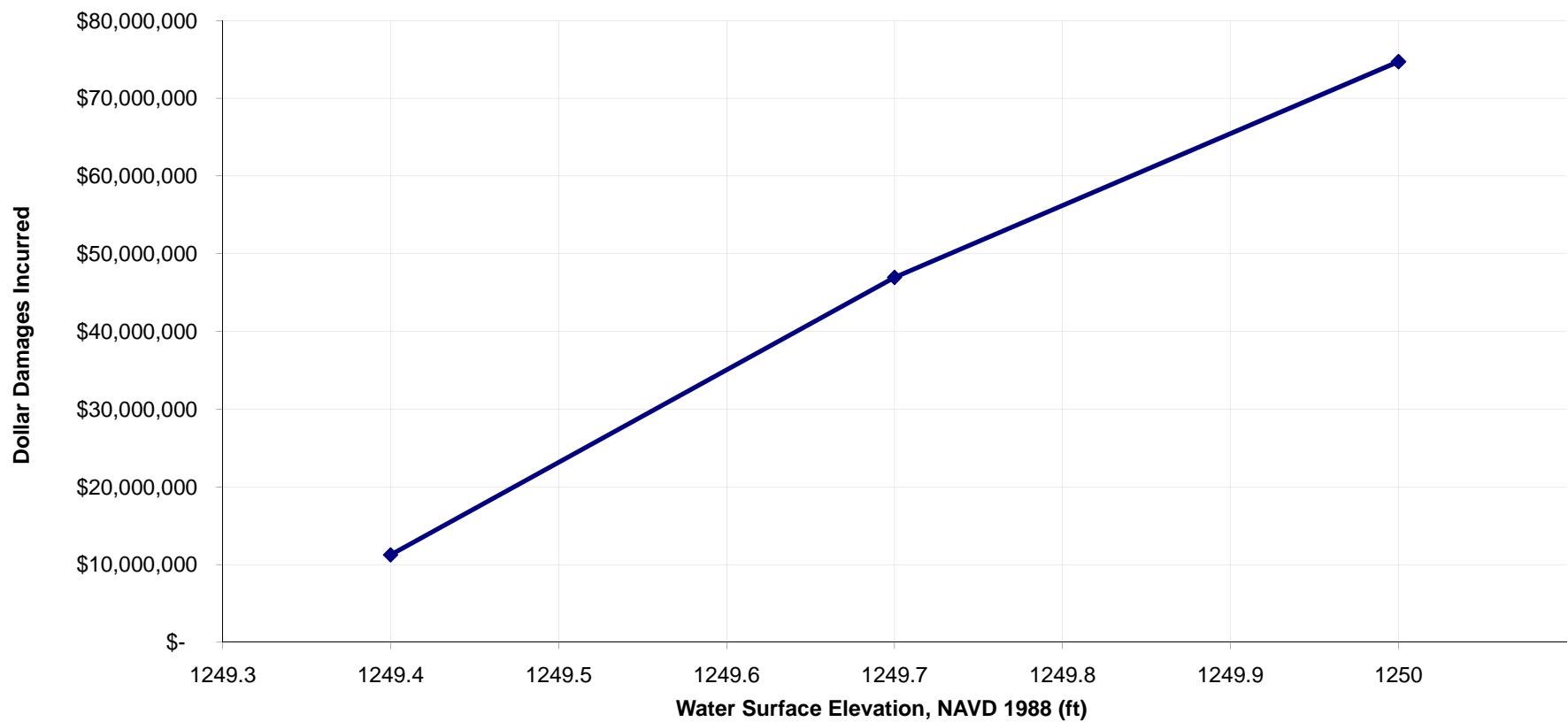
Calculation of With Project EAD

	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	
Average Recurrence Interval (ARI)	25	50	100	0	0	0	0
AEP	0.040	0.020	0.010	#DIV/0!	#DIV/0!	#DIV/0!	0
Actual Damage to Residential Buildings (\$)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Potential Damage to Residential Buildings (\$)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Actual Damage to Commercial/Industrial Buildings (\$)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Potential Damage to Commercial/Industrial Buildings (\$)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Damage to Agriculture (\$)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Damage to Roads (\$)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Actual Indirect Costs	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Potential Indirect Costs	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Special Cases	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Total Actual Damages	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Potential Damages	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

EAD (Actual)
EAD (Potential)

\$ -
\$ -

Actual Flood Damage v Stage (without project)



Actual Loss-Probability Curves

